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ABSTRACT

To encourage teachers to use the out-of-doors in their teaching, this booklet has been prepared by the Ontario Teachers' Federation. It reviews basic approaches to out-of-doors instruction, types of field trips, teacher training and sources of instructional assistance, pre-planning and follow-up for a field trip, and points to consider in evaluation. Following this are 200 outdoor science activities, each of which allows direct exposure to material things out-of-doors so pupils may gain an appreciation of their environment and an understanding of ecological relationships. Animals, birds, geology, insects, meteorology, physical science, plant life, snow, temperature, and trees are the topics of study. Each activity is briefly described and coded for unique environment or activity area (stream, marsh, open field, school year, woodlot, all areas). Concluding information lists resource books for both teachers and students in many areas of natural resources. (BL)

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ONTARIO TEACHERS' FEDERATION

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200 OUTDOOR SCIENCE ACTIVITIES

SE 014 413

200 Outdoor Science Activities

A Classroom Extension

Ontario Teachers' Federation

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200 OUTDOOR SCIENCE ACTIVITIES

prepared by

The Ontario Teachers' Federation
Science Curriculum Committee

1969

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Part I

FOREWORD

The aims of a school program should be to encourage the development of the child's ability to enjoy himself thoroughly and to function efficiently in our democratic society. Increased technology and urbanization emphasizes the need for teaching wise use of leisure time and stresses the urgency for learning good conservation practices. Correct scientific attitudes and a high degree of scientific literacy will be needed by the future citizen if he is to live at ease in the world — some scientists would say if he is to live at all.

Direct exposure to material things from the out-of-doors allows pupils to gain an appreciation of their environment and an understanding of ecological relationships. The opportunity to satisfy one's curiosity about real things in the out-of-doors excites and stimulates a child. Stress must be placed on the development of skills rather than content-oriented curriculum to achieve these goals.

Outdoor education is not an isolated study but an approach to learning, involving the integration of many subject areas.

Part II

A. APPROACHES

There are two basic approaches to the out-of-doors.

1. The teacher organizes and assigns specific tasks.

2. The pupil sets his own task but needs teacher guidance in order to develop critical thinking. The current trend is to learn by doing and to be involved.

B. TYPES OF FIELD TRIPS

1. Single Item Sallies — One or two pupils may be dispatched briefly from the classroom to find out something for the whole class. This is the simplest form of field trip.

2. Schoolyard Trips — Well organized trips in regular school time to the yard or adjacent fields can be valuable. Field work during classtime may be continued daily or seasonally. This should be the first kind of field trip experienced by the whole class.

3. Longer Field Trips — These trips take a class to a specific area e.g. park, woods, farm, factory or pond. Probably these will be for a double period or a half day.

4. Science Centres or School Outposts — These are set up in a particular area with necessary facilities at the location. A class will participate in the program provided by trained instructors for one day or extended time periods.

5. Residential Outdoor Schools — These enable students to take part in a program for more than a twenty-four hour period.

C. TEACHER TRAINING

A teacher who wishes more information about outdoor science has several sources of help.

1. Reference books such as — John Sankey's **A Guide to Field Biology** (Longmans) contain techniques for qualitative and quantitative surveys of field, stream and woods, as well as giving a good reading background of ecology. Both the questions, What kind of? and How many of? are relevant in this field. Through such study a teacher will begin to acquire a 'land ethic' of his own, a feeling of conviction, based upon some real understanding of what is best for true conservation of natural resources.

2. Teachers may urge professional affiliates to arrange conferences such as FWTAO organized in Toronto in 1967. Lectures, films and workshops introduce new field activities and teach how to conduct them.

3. A teacher can go to a Departmental Summer School. These schools have been leaders in the field of outdoor science for the past years, featuring special weeks at the Albion Hills Conservation School.

4. In 1969, the Ontario Department of Education is conducting a summer school course at the field centres of Great Britain.

5. In 1969, the Ontario College of Education is running an outdoor science course for qualified teachers at Albion Hills.

6. A teacher can go to such weekend training in outdoor work as OTF conducted in 1968 at their property at Eagle Lake. Science personnel and principals might be persuaded to use this pattern to develop such work in their own district.

7. A teacher can go along and learn with her class if they are in an area where classes are being taken out of their schools and bused to a day-school in the country for instruction in ecology and nature study. In this way many teachers from Ottawa, Etobicoke, Cobourg, North York, Sudbury, Huntsville, Peterborough and Kingston, to name some new programs, are learning the ways of the wild. Permission is often granted to attend these schools to observe. Inquiries may be made at the board offices concerned.

8. Some of the best in-service training in outdoor studies is obtained by teachers and student teachers who accompany classes for week-long training at outdoor schools such as Toronto's Island School or Albion Hills.

9. Conservation areas have conservationists who will help. Similarly the Department of Lands and Forests and the Federation of Ontario Naturalists will supply resource people.

D. PRE-PLANNING

(a) Before the Trip:

1. Necessary permission should be received from landowners and school officials.

2. Necessary consent forms should be sent to parents. A sample form is included in the appendix.

3. Relevant lessons should be taught to the class in advance.

4. The class should be divided into suitable working groups.

5. The area to be visited by a class should be well known to the teacher.

6. Children should be readied for their new experience by discussing suitable clothing, equipment, materials and conduct.

7. A field trip is most beneficial when it is given a purpose, but do let a class deviate and discuss other material. For instance, en route by

bus, capitalize on what you pass. The pupils might be provided with a list of questions to focus their attention, or they might be asked to return to class with a number of observations they might wish to discuss.

(b) **Suggested Plan for a Typical One-Day Field Trip:**

1. Orientation session at the site to establish standards of behaviour and working routines.
2. Interpretative nature trail hike to familiarize the class with their surroundings.
3. Activity session as indicated in Part III.
4. Lunch.
5. Activity session.
6. Oral reporting session for all groups.

E. FOLLOW-UP

Frequently the actual time in the field is all too brief. Children must be given ample time to complete meaningful follow-up **immediately** upon their return to the classroom.

Follow-up provides an opportunity for the **integration of subjects.** Children must be supplied with adequate materials in order that they can share their findings with the rest of the class. This may be done through the use of mathematical charts or graphs; language experience either orally or by creative writing; by way of art or crafts.

F. EVALUATION

— Have pupils gained a greater acquaintance with their natural surroundings through the media of their senses, especially sight and sound?

— Have pupils attempted a scientific method of observation and a form of classification?

— Have pupils progressed toward grasping scientific principles?

— Have pupils had the opportunity to expand their own interests and to search for answers to individual questions?

— Has there been an attempt by pupils to see an orderly arrangement within nature?

— Was there good pupil participation?

— Was pupil curiosity aroused sufficiently to encourage a variety of research activities in the follow-up?

— Were pupils willing to share knowledge gained?

— Was there enjoyment?

Part III

200 Outdoor Science Activities

KEY TO ACTIVITY AREAS

S — Stream
M — Marsh
O — Open Field
Y — School Yard
W — Woodlot
A — All Areas

1) ANIMAL ACTIVITIES

1. Scoop up a plastic bag of leaf litter and humus from a wooded area. Sift this through a sieve over a white sheet of paper to see what organisms are present. Sift through what is left in the sieve and compare the forms of life. — W

2. Bring back a variety of insects, snails, worms and other animals from a field trip. Classify them according to external characteristics such as leg joints, hair on the body, number of eyes, and other characteristics suggested by the pupils. You might give the assignment of classifying as the groups feel this should be done. — A

3. Locate and count the number of species of small animal life along the banks of a stream, in the mud, and in the water. Catch them in kitchen strainers or in nylon stockings sewn to coat hangers. Transport your catch in baby-food jars. — S

4. Catch tadpoles. Bring them to the classroom. Feed them on commercial fish food. They will live in ordinary tap water. Record their physical change pictorially. Record their activities and weight changes. — M S O

5. Tie some cheesecloth between two hockey sticks. Weight the bottom down. Have students run upstream for a few yards and see the type of water animals they trap. Hold the net at 45°. — S

6. Have the class fasten nylon stockings to coat hangers. Use these as dip-nets to catch fish, insects, and other animals along the bank of the stream. — S

7. Make a fishscope of heavy cardboard or stovepipe and an acetate sheet to observe animal life, bubbles, etc., on the bottom of the stream. — S

8. Calculate the population density of animal life in the stream at points of rapid water, still water, deep and shallow water, warm and cold water, etc. Note changes over the seasons. Use a simple seine or dip net. — S

i) This requires two trips.
ii) Catch and mark with water-proof marker or, in the case of fish, notch a fin. Record the number of one species.
iii) On the second trip follow the same procedure, but do not mark. Keep track of the number of marked specimens recaptured.

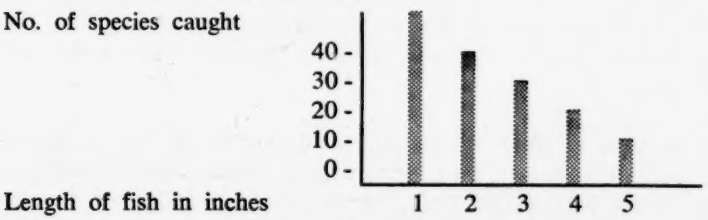
Formula for Calculating Population:

$$\frac{C_1 \times C_2}{R} = \text{Approximate Population}$$

Interpreted, this means — Number in the first catch, multiplied by the number in the second catch and divided by the number re-caught will give an amount approximating the population.

*If no marked specimens are recaptured, the formula yields an infinite number which is not the case. The answer, at best, is only a rough approximation because of the number of variables involved e.g. temperature, time of day.

9. Construct a population pyramid for each species caught. Compare time
A of day, area of stream, rainfall, etc.



10. Attempt to find a correlation between the numbers of different species of plant and animal life in an attempt to discover a food chain. This
A would be a good time to stress the disrupting results of many classes collecting specimens from one area — TAKE NOTHING BUT PICTURES — LEAVE NOTHING BUT FOOTPRINTS!

11. Identify plant and animal life which might compose food chains by observing animals feeding.
S i) Plants — kind and relative amount.
M ii) Insect larvae — stoneflies, dragonflies, damselflies, caddis flies, blackflies, mayflies, midge flies, etc.
iii) Snails, crayfish, water striders, diving beetles, red worms, tadpoles, "minnows", backswimmers, etc.

12. Measure the size of fish and try to determine its age.
S i) Head to tail-notch equals relative age.
ii) Remove one scale and examine it under a microscope, Count growth rings to determine age.

13. Make a list of **apparent** conditions necessary for the maintenance of a particular species in terms of what you have observed: speed of water,
S acidity of water (using a PH Kit), depth, nature of bed and bank, light conditions, available food, etc. Try to decide whether the conditions are favourable for the introduction of a foreign species. For example,

10

would brook trout be able to live and reproduce here? This activity, while worthwhile discussing, should **not** be carried out because of the possibility of disrupting existing balances.

14. Observe and make a map showing amounts of shade, population distribution, degrees of erosion, depth of stream bed, location of pools, rapids, etc. S

15. Perform similar activities in four different seasons to discover any changes which take place. Where do the animals go when the stream freezes over? What is the first date on which you discover crayfish? S

16. Observe live specimens of pond life using microscope slides or petri dishes on a micro-projector or an overhead projector. S M

17. Start a colony of protozoic life by putting grass, weeds, or lettuce leaves in a jar of water. Let this stand. S M O

18. For information regarding classroom care of stream animals, FOR A **SHORT** PERIOD OF TIME, consult the **UNESCO Science Source Book.** S

19. Observe, identify and record animal tracks. Make plaster of paris casts of tracks found in the snow. Spray a little water or hairspray on the snow around the track to harden it before pouring the plaster. Learn to read the tracks to tell direction of movement, speed and relative age. Note food sources or signs of resting in the vicinity of tracks. Have the children compose stories predicting the reasons for the animal having passed that particular point. A

20. Follow mice tracks in the snow to find the entrance to the burrow. A

21. Measure the distance between rabbit tracks to find an average length of jump. A

22. Take a 15 minute hike in your area and record all the various animal signs that you can find. A

2) BIRDS

1. Place a variety of foods in a bird feeder, constructed by the children, and consider the following: Y

   (a) Which kind of food does each species seem to prefer?

   (b) What does the bird do with the food? What size of piece does it seem to prefer? Does the bird have to hold the food to eat it?

   (c) Which species pick up the food and fly to cover to eat it?

   (d) When no feeder is used, which species prefer to eat
   i) in the open?
   ii) under bushes or shrubs?

   (e) Compare species in the ability and agility to obtain food and eat in different locations.

(f) Compare species in terms of their ability to learn
   i) to come to a specific place for food
   ii) specific feeding times.

A 2. Compare the natural feeding habits of species common to your area.

A 3. Relate selection of the kind of food chosen by each species to its bill structure.

A 4. Study the changes in feather coloration of one species from young to adult, male and female, season to season.

Y 5. Construct a feeder which will weigh the birds as they feed.

6. Observe and compare the flight patterns of different species. Note especially
   i) gliding or lack of it
A ii) landing
   iii) take-off
   iv) position of the feet during flight and landing
   v) usual flying height.

A 7. Observe and compare the nests of various species in terms of materials, artificial and natural.

A 8. Look for relation of nesting site to
   i) sun
   ii) prevailing wind
   iii) proximity to natural feeding areas.

9. Find nests of different species and, from a distance, compare the young. Some possible points of comparison might be
   i) month(s) of birth
   ii) number
   iii) manner of feeding by adult(s)
A iv) number of broods per season
   v) habits of young before and after feeding
   vi) length of time fed by adults
   vii) kind of food presented by adults — how does it differ from adult food?
   viii) frequency of feedings — how might you increase this?

A 10. Compare the walking, running, hopping, or striding habits of various species.

A 11. Study bird sounds. Obtain a record of bird calls and attempt to imitate them. Try to get birds to respond to your call.

A 12. Observe groups of birds in an attempt to find out what alarms them, how they communicate alarm to each other, how different individuals react to alarm.

A 13. Study group behaviour of birds from the point of view of
   i) leaders or lack of them
   ii) flying routes: regular or irregular

14. Compare the habits of species which flock to those which do not flock. A

15. Choose specific times of the day and count
    i) the total number of birds seen
    ii) species seen Y
    iii) number of each species seen.
    Study the accumulated data over a long period of time from the points of view of patterns of population, arrival and departure of migrants, etc.

16. On a map of the area (drawn by pupils) mark the bird population and observe distribution. A

17. Build a list of points which might be used to identify an unknown bird e.g. size, colour, song, habits, number of young, nest, etc. A

18. In late fall collect abandoned nests and find out the materials used in their construction. Compare the materials to those available in the proximity of the site. A

19. Observe and compare the feet of birds in terms of size, shape and use. A similar study might be carried out using wings. A

20. Examine and possibly attempt to reconstruct the skeleton of a chicken. Discuss the structure and function and test the strength of various bones. Compare cross-sections of chicken bones with bones of other animals. A

21. Observe birds to test the validity of using birds to forecast weather. How does the weather affect the behaviour of birds? A

22. Compare the kinds of feathers found on a bird. Discuss their function, structure and properties. A

23. Visit a marshy area and a wooded area. Have each child identify one bird in each. Try to find out why birds prefer one area to another. M W

24. Find seeds and fruits that serve as food for birds and small mammals in winter. A

25. Search an evergeen grove for an owl's roosting site. Then collect owl pellets for dissection. Break these clean, odourless pellets apart. Comparing the bones, decide what animals the owl has eaten. Try to reconstruct one of the skeletons. W

26. Use a key chart and identify birds by their silhouette during flight. A

27. Obtain feathers of water birds and land birds. Soak them in water and note the differences. A

28. Obtain feathers of water birds and examine them under a microscope. S M

29. Build identical bird houses except for the size of the hole. Find out if the difference in size is a factor for the choice of a house for a given species of bird. A

30. TRACKING — Observe, record and try to identify bird tracks in the snow or soft mud. Learn to read the tracks to tell the direction of movement. Note food sources or signs of resting in the vicinity of the
A tracks. Have pupils compose stories suggesting the reason for the bird having passed a particular point. Spray a little water or hairspray on the snow around the track in order to harden the snow. Then, make plaster of paris casts of tracks. Measurement exercises involving the length of steps or hops make interesting comparative studies when graphed.

31. BIRD FEEDERS — Junior classes will enjoy making their own suet Dixie-cup feeders. Suet in a pot can be melted over a camp stove in the schoolyard. Each child places his Dixie-cup in a depression in the snow. A cord is knotted through the base of the cup and held upright. Liquid
Y suet is poured into the cup and seeds are added. On a cold day the suet hardens quickly. If the cord has been held erect, the paper cup can be torn away and the feeder attached by the cord to a branch. Pupils will soon suggest other simple feeders, such as peanut jar lids filled with suet and nailed to a piece of board.

32. BIRDS' NESTS — Winter is the only time that humans can interfere with birds' nests without upsetting a bird's nesting rhythm. Locate old nests and take them back to the classroom. If pupils work in small groups, several different nests can be dealt with at once on a comparison
A basis. First measure and weigh the nest. Carefully dissect the nest exploring the intricate construction, the engineering design and kind of materials used. Sort out and classify materials. Using the same materials, try to reconstruct a nest. A bird uses only its bill and feet as tools in nest construction. How do these compare to our hands as tools for the job?

A 33. When you go looking for birds, carry an identification book and learn how to use its key.

A 34. Record the place that you observe six different birds. Try to find out why they are there.

35. Observe an unknown bird. Jot down its characteristics or make a pencil
A outline or put a description on a portable tape recorder. You might also be fortunate enough to record its song.

A 36. Record details concerning the movement of every bird you see.

3) GEOLOGY

1. Using a stream or ditch containing running water as a model, have the
S students sketch geographical formations such as island, peninsula or isthmus.

2. Measure the hardness of soil in various areas by measuring the depth
A a hardwood peg or iron bar penetrates the ground when given fifteen uniform taps. In each area repeat the process five times and obtain an average. Repeat the process on paths, cultivated and uncultivated areas.

M 3. To measure how porous the soil is take a juice can. Remove both ends.

Stand it on top of the soil. Record the time needed for a measured amount of water to penetrate the soil. Take at least three readings in different places.	W O Y
4. Examine the deposited material at the bottom of an eroded site. Account for the larger and heavier materials building up where they do.	A
5. Run gravel through your fingers. Sift it. Classify the particles as to colour, shape, size, glint.	A
6. When a "washout" is found, trace back to the source of the materials and observe the place that has become eroded. Describe the features and suggest reasons why the erosion took place.	A
7. Measure the width and depth of a ditch. Draw a profile of it and mark the chief types of vegetation.	A
8. In winter, use a crowbar to find how far the frost has penetrated the ground and at what depth the soil becomes soft.	A
9. In winter, drill holes in a vacant lot and take temperature readings at varying depths. At what depth is the soil the warmest?	O
10. Construct a simple weather vane and use it to find the changing direction of the wind across a given area. Plot your data.	Y
11. Take your pupils on a tour of a stream. Let them browse and explore, and then have them list things that they might wish to study.	S
12. To introduce the topic of "streams", a tour of a stream might be made to make sketches of plant life, eroded areas, etc.	S
13. Have each pupil sketch a map and mark on it islands, sand bars, gravel beaches, muddy areas, log jams, rapids, boulders, pools, eddies.	S
14. Measure the speed of a stream. Determine this by averaging the time various objects require to travel a known distance.	S
15. On various occasions during the year, especially after a heavy rain or during a dry spell, measure the speed of a stream (a) in deep and shallow water (b) when passing over mud, sand and stone (c) in areas of heavy and light vegetation. VELOCITY = DISTANCE × TIME (average time over several trials).	S
16. Relate the thickness of ice over a stream to its velocity during non-winter months.	S
17. In cubic feet per second, establish the rate of flow of a stream. (Chosen) LENGTH × (average) WIDTH × (average) DEPTH × .8 = cu. ft. sec. *The .8 is the friction coefficient and accounts for differences in velocity at different depths along the bank.	S
18. Make a cross-sectional diagram of a stream.	S

S 19. By damming a narrow point of the stream or re-routing the water, choose a point in the stream and dig a hole to make a profile. Note especially the layers of sedimentary deposits. Compare your findings to a similar profile dug in the bank.

S 20. Temporarily dam a section of a stream and note the immediate effect on the flow of water both above and below the dam. Relate your findings to natural and man-made dams, water conservation and management.

S 21. At points of high erosion, note the composition of the bank and try to find a similar collection of materials deposited down stream. Explain why they were deposited at one particular spot.

S 22. When a stream begins to slow down, notice what kinds of materials settle out of the water first. For comparison, collect some muddy water and small stones in a jar. Shake the contents well and let them settle. Compare the results in the jar to the stream bed at various points.

S 23. Measure the level of acidity of a stream through use of an aquarium testing kit. The Ph. (percentage of hydrogen ion content) might be the basis for deciding whether the stream would maintain a particular species or whether an existing species would survive elsewhere.

S 24. Measure the temperature of a pool or pond both at the surface and at
M determined depths below the surface. Repeat this at 24" intervals across the pool or pond and plot your findings.

S 25. At intervals of two feet up the bank of a stream, take mud samplings. Use a kitchen sieve to wash away the mud, and record the number and types of snails, etc. that are left.

S 26. Dig a soil profile on the bank of a stream and measure the depth of the varying colours.

S 27. Conduct hardness tests of the water at various points of the stream by adding detergent — a drop at a time, to a given amount of water in a container. Record how much is added before suds form.

M 28. Conduct temperature surveys along the banks, in the middle, in pools, in rapids, in deep and shallow water, in the shade, etc. Note differences
S in soil, air and water temperatures at a given time and at different times of the day.

S 29. Using maps, etc. try to discover the source and mouth of the stream. Calculate the length of time required for a floating article (assuming no barriers) to travel the entire length of the stream.

S 30. Attempt to find the effects of a particular stream on the environment e.g. irrigation, erosion, etc. To what extent is the stream the result of the landforms? What changes has the stream made in the landscape? What changes might it make in the future? How has (or might) man make use of the stream?

4) INSECT ACTIVITIES

1. Make insect nets from coat hangers and mosquito netting.	A
2. Given a ten-minute time limit, catch a variety of insects. Record where each was caught. Record in the classroom three things that made them difficult to catch.	A
3. Use a hand lens to examine the heads of several insects. Pay particular attention to the antennae and eyes. Make pictorial records of what you see.	A
4. Sketch in the field various parts of insects. Enlarge these and make a composite mural. Make a moveable model of an insect using bristol board and paper fasteners. Model an insect by using wire and papier mâché.	A
5. From a field trip bring back a variety of insects, snails, worms and other animals. Classify them according to external characteristics suggested by the pupils.	A
6. Listen for insect sounds. Find the insects. Identify them.	A
7. Sit very still in the middle of a field and try to identify insect sounds Try to imitate them. Use a tape recorder. From recorded sounds (F.O.N.) check to see if you are right.	O Y
8. Find a dead tree that has fallen over. Carefully lift a section of bark. Count and record the different types of insect life you see. Be certain to replace the bark carefully!	M W O
9. Walk through your open area and record examples of nature's camouflage observable in the relation between insects and the plants they visit.	M O Y
10. Examine ten different milkweed plants. Record how many milkweed beetles or other insects are on each plant.	O M
11. Select one flowering plant e.g. milkweed, goldenrod or wild aster. Count the number of insect visitors that it has in a five-minute period. Why did each visitor come to this particular plant? (to feed, to rest, to lay eggs, etc.)	A
12. Search for eggs or larvae of the monarch butterfly on milkweed plants in early fall. Rear to adulthood.	O M
13. Catch monarch butterflies. Ask your teacher to write: Dr. Fred Urquhart, Head of Monarch Research, Scarborough College, West Hill, Ontario, to find out about tagging them in order to trace migration routes.	O M
14. Look for cocoons. Place these in an outside cage for winter.	A
15. Find a clump of goldenrod. Search through it to find goldenrod ball galls. Open one to find what made the deformity.	A
16. Collect another goldenrod ball gall. Place it in a bottle with a piece of	A

netting over the top. Watch carefully each day to see what adult fly emerges.

A 17. Look for and collect examples of galls. Although there are hundreds of galls, only about 12 plants are their hosts e.g. willow, maple, oak.

Y W O M 18. How do ants travel through a grassy area? Place several bits of stones in their pathways. Do they travel over or around objects? Compare this to the behaviour of the mealworm or other animals.

A 19. Measure the distances which various insects hop. Plot these on a graph and compare the distance to the size of the insect and to the weight of the insect and leg size etc.

S 20. Mark off a ten-foot line leading from the bank of a stream. Every two feet examine the plants, the surface of the ground and the soil (to a depth of six inches) note the type of insect found. Find the number of different species and precisely where they are found. Record precisely where each different species was found.

A 21. Do an insect population count. Collect 50 grasshoppers in a given area and dab fingernail polish on the inside of one back leg of each. After half a day catch 50 grasshoppers in the same area and note number of recaptures. Apply this formula:

$$P = \frac{C_1 \times C_2}{R}$$

P = population
C_1 = count 1
C_2 = count 2
R = recapture

5) METEOROLOGY

A 1. Draw the shape of the clouds over several days. Record the type of weather experienced.

A 2. On a windy day, place a thermometer in a cardboard box and find the temperature of the air. Expose the thermometer to the wind and do the same thing. Repeat this procedure on several days to see if the wind affects the temperature.

Y 3. Record the wind direction at several areas surrounding the school. Move close to the building and back from the building.

Y 4. Construct an anemometer out of ping pong balls or paper cups, aluminum foil, etc. With this homemade timing device, measure the number of times it will turn at 6", 1', 2' and 3' above the ground. Take each reading five times and average them. Record your data. Communicate to the class using a graph. Repeat by seeing how high the wind will blow an attached strip of paper.

Y 5. Make pinwheels and take them outside. Observe what happens when you change the variables — their size, friction on stick, amount of breeze and number of turns.

6. Do objects affect the direction of wind? Use a homemade weather vane to find out. Y

7. Trace each others' shadows. Y

8. Does a person's shadow change throughout the day? Record the length and width of the shadows of several people. Do this throughout the year. Y

6) PHYSICAL SCIENCE

1. Study the effects of radiation and absorption of heat. If you placed sheets of metal or plastic painted different colours on a layer of snow on a sunny day, around which would the snow begin to melt first? Y

2. Taking temperature readings beneath various types of winter clothing, e.g. heavy and bulky versus fur lined, discover the advantages and disadvantages of each. Y

3. Using photographic lightmeters, observe the reflection and glare from light snow, wet snow, ice, etc. on both bright and dull days. Y

4. Find objects which resemble the four basic shapes — round, square, rectangle, triangle. A

5. Test the hardness of water by seeing how many drops of detergent are needed to get a lather of a certain height. In each case, fill a pill vial half full of the water to be tested. Add detergent a drop at a time and shake. The harder the water, the greater number of drops of detergent will be required. S

6. On a suitable hill children could set up experiments to answer the following questions:

   (a) How is the distance travelled by a toboggan affected by the following: O
   - i) weight carried
   - ii) length of the toboggan
   - iii) type of toboggan (aluminum, wooden, sheets of plastic, cardboard boxes, etc.)
   - iv) shape of toboggan
   - v) waxing
   - vi) position of the rider(s) on the toboggan
   - vii) stance of rider(s)
   - viii) slope of the hill
   - ix) snow depth
   - x) snow condition?

   (b) How is the speed of the toboggan affected by (i) - (x) above?

   If the class were divided into ten groups each one studying the toboggan from the point of view of one of (i) - (x) in terms of distance, speed and control, they would each make up a set of questions to be answered by experiment.

e.g. Group E Waxing

1. Does the brand of wax have any effect on
   a) distance
   b) speed
   c) control?
2. What difference is there between liquid and paste wax on a, b, and c above?

7) PLANT LIFE

O 1. Classify wildflowers by colour, size or leaves. Do this while crossing an open field.

A 2. Find out how many petals various weeds of the same variety have in their flower.

A 3. Collect bouquets of field flowers (weeds).

A 4. Collect dandelion seeds and plant them at various depths, Do they all sprout?

A 5. Look for three different types of seeds and bring them back to the class in baby-food jars.

A 6. Collect dry weeds that appear above the snow. Make bouquets and spray paint the arrangements. Examine them for seeds.

A 7. Collect seeds of various weeds. Plant them in eight baby-food jars filled with such substances as soil, gravel, sawdust, vermiculite, face powder, wood chips. Keep them moist. Will seeds grow in substances other than soil?

O 8. Make a display of seeds. They might be classified by shape, size, colour or how they travel.

Y O 9. Stake out a piece of lawn where grass and some broad leaved plants are growing. Sample the number of plants per square inch. Measure and graph the size of the leaves over a period of time.

A 10. Find evidence that broad leaved plants are more vigorous.

A 11. Find evidence to prove or disprove that plants discard leaves that cannot manufacture food.

A 12. What type of vegetation do you find in a ditch?

A 13. Mark a line up the side of a bank. Identify the plants as you move upward. Plot your findings on graph paper.

A 14. Put plastic lunch bags over several plants and make an air-tight tent. Does the amount of moisture given off vary according to the size of the plant?

15. At two-foot intervals for twenty feet, carefully remove one plant. Classify the root as **tap** or **fibrous.** Find the length of an "average" root on each plant. On which side of the plant are most rootlets growing? How deep does the "average" root grow? A

16. Dig up several weeds and note their root size in comparison to the plant's total size. A

17. Measure the height of field grasses and weeds. Make a comparative graph for each. O Y

18. Plant lily pads in a flower pot. Transfer them to your aquarium. S M

19. Find four varieties of fern. Examine their total environment. Determine requirements of a particular variety. Look for evidence showing how they reproduce over a given area. A

20. Find various types of moss. Plant them in a container which can be covered and let them continue growing because of the water cycle. A

21. Examine leaves to see if they each have a **midrib.** A

22. Make a collection of **compound** leaves. A

23. Collect leaves which are **parallel veined** or those which are **net-veined.** A

8) **SNOW**

1. Measure the depth of tire tracks from different cars and trucks. Compare the students' tracks in a similar way. A

2. Measure the depth of footprints made on packed snow. Relate data to weight of student or animal. A

3. Measure the size of footprints made by different students. Relate data to the height of the students. A

4. Observe tracks made by different cars in fresh snow. Y

5. After a snowstorm, measure the depth of snow at different points in the school yard. Make a graph and find how many inches of snow have fallen. Y

6. Find the places near the school where the snow is deeper. Relate your findings to the proximity of buildings. Y

7. Dig through a snow bank and thus make a cross-section. Record the thickness in inches of the faint colour changes. Record the results on squared paper. Take temperature readings at regular intervals. A

8. Examine each snow layer with a lens to see the differences. A

9. With a lens, examine fresh snowflakes on cold black construction paper, or aluminum pie plates painted black. Sketch some of them. Take Y

outside temperature each time. Does the temperature affect the general structure of snow flakes?

O 10. Sketch the drifting of snow. Measure the distance between drifts in an open field. Compare snow drifts to water waves.

Y 11. Build an igloo or snow house and take temperature readings inside and out.

Y 12. Mark off several square foot areas across a blanket of snow. Dust a different colour of tempera paint on each one. See if the colours used affect the temperature readings.

Y 13. Measure the width of icicles from top to tip. Make a graph. Sketch interesting formations.

Y 14. Observe and sketch the formation of ice crystals on shallow pans of water using hand lens and microscopes. Note expansion of water when freezing by partially filling old jars with water and letting them freeze. Record length of time required, amount of expansion, etc.

Y 15. Observe and sketch frost formations on windows. (Note changes in accordance with different temperatures.)

A 16. Observe and sketch the results of an ice or sleet storm.

A 17. Conduct experiments on ice related to friction.

9) TEMPERATURE

Y 1. Use a spike and hammer. Drill holes in the ground to varying depths. Insert a thermometer in the drilled holes. Leave it for five minutes. Record the temperature. Depths should be 1″, 2″, 3″, 4″ to 10″. Take four readings in each case and average them. Account for the differences. (Be sure to shield the thermometer from breezes.) Repeat in winter with snow and ice.

Y 2. Cover two areas with black and white cloths. Take temperature readings of the soil below them. Repeat using metals, etc.

A 3. Find out if the colour of soil affects its temperature.

A 4. Find out if the texture of soil, e.g. sand versus clay, affects its temperature.

A 5. Find out if the soil temperature varies with the slope of the land. Take readings in several flat areas, gently sloping areas and steep areas. Try a shaded area and a sunny area.

A 6. Compare the soil temperatures in an open unplanted area with the temperature in (a) a grassy area, (b) under a tree, (c) in long grass, (d) on a gravel path, etc.

Y 7. Shield a thermometer from the sun and take temperature readings of

various objects surrounding the school. Compare these temperatures when the same objects are snow-covered.

8. Conduct temperature surveys in open fields, close to buildings, at the base of trees (windward and leeward). A

9. Tape thermometers at 2" intervals up a tree. Shield the bulbs and take readings several times during the day. A

10. Choose a large puddle. Record the temperature across it at one foot intervals. Do the same for ten feet in both directions. What do you observe? Note temperature versus depth relationships. A

11. Measure the relative humidity 1" above the surface of the ground. Do this by recording the temperature on an ordinary thermometer and the temperature on a thermometer whose bulb is wrapped in wet cotton. Subtract the two readings. Change the difference to a percentage. A

10) TREES

1. Feel the trunks of many trees. Classify them as to whether they feel smooth or rough. A

2. Look for four types of nuts which have fallen from different trees. Is there any relationship between the size of the tree and the size of the nut? How does the ratio between the nut and tree circumferences compare within the same species? Plant the nuts. Graph the rate of growth. A

3. Estimate the height of a tree with a pencil by the "tree-felling" method. Tip the pencil as the tree would fall. Mark the spot where the top of the tree would fall by having a pupil stand on the spot. Measure from tree to spot with a tape measure. A

4. Estimate the height of a tree by standing a person beside it and decide how often he would fit against the tree. A

5. Locate six trees with different colours or distinct shades in their bark. Identify the trees. A

6. Arrange leaves according to the shade of green they contain. Is there any similarity between this and other physical traits of the tree? A

7. Find which trees have no leaves and which trees continue to grow in winter. A

8. Winter is a good time to learn distinctive tree shapes and identification by bark and buds. Do some field sketching in conjunction with these activities to make the children look more closely. A

9. Sketch the "typical" shape of five trees. A

10. In late winter, walk through a woodlot noting the buds on the trees. Which trees show signs of beginning growth? W

A 11. Collect twigs from different trees to see if they are resting. Place them in water to see which ones will develop.

A 12. Find the differences between leaves of different coniferous trees.

W 13. Find the differences in the bark of conifers and deciduous trees by bark rubbings.

W 14. By measuring the circumference and height of trees, find out if there is a relationship between the two.

W 15. In the spring, look for flowers on the Manitoba maple, sugar maple, silver maple, white elm, aspen poplar, balsam poplar, cottonwood poplar, willow, basswood, etc.

W 16. Try to find two kinds of flowers on poplar, willow and Manitoba maple trees. Examine them for differences.

A 17. Try identifying conifers by their fruits. Notice the change of position of the cones, if any, as they mature.

Y 18. Make a survey of the foundation planting in your locality and assess how successful each plant is.

W 19. Plant a tree. Gather data to make this a success.
O
Y

RESOURCE BOOKS

Animal Tracks

1. A field Guide to Animal Tracks — O. Murie (Peterson Series) pp. 375, 1963	Houghton Mifflin Co., Boston	$5.95

Mammals

1. Canadian Mammals — Austin Cameron, Department of Northern Affairs & Natural Resources, pp. 81, 1964	National Museum of Canada, Ottawa	$ .75
2. Mammals — A Golden Nature Guide — Zim & Hoffmeister, pp. 160, 1955	Golden Press, N.Y.	$1.35
3. The Mammal Guide — R. S. Palmer (Doubleday Nature Guide Series)	Doubleday & Co. Inc., Garden City, N.Y.	$5.95

Fish

1. Fishes — A Golden Nature Guide — Zim & Shoemaker, pp. 160, 1963	Golden Press, N.Y.	$1.35
2. Field Book of Freshwater Fishes of North America — Schrenkeisen, pp. 510, 1940 (Putnam Nature Field Book)	G.P. Putnam's Sons, New York 16, N.Y.	$4.95
3. A Guide to Freshwater Invertebrate Animals — T. T. Maean	Longmans Canada, Don Mills	
4. Freshwater Ecology — T. T. Maean	Longmans Canada, Don Mills	
5. Fishes — Golden Nature Guide — Zim & Shoemaker	Golden Press, New York (available at any bookstore)	$1.35
6. Crayfish — Elementary Science Study		
7. Pond Life — Golden Nature Guide — Zim & Reid	Golden Press, N.Y.	$1.35

Frogs and Reptiles

1. Reptiles and Amphibians — A Golden Nature Guide — Zim & Smith, pp. 160, 1953. E. S. S. Unit — Tadpoles	Golden Press, N.Y.	$1.35
2. Zoology — Golden Science Guide — H. S. Zim, R. W. Burnett, H. I. Fisher	Golden Press, N.Y.	$1.35

Sea Shells

1. Canadian Atlantic Sea Shells — E. L. Bousfield, Department of Northern Affairs & Natural Resources, pp. 72, 1960	National Museum of Canada, Ottawa	$1.00

Birds

1. A Field Guide to the Birds — R. T. Peterson, (Peterson Series) pp. 290, 1934, rev. 1963	Houghton Mifflin Co., Boston	$5.95

2. Birds — A Golden Nature Guide — Zim & Gabrielson, pp. 160, 1949	Golden Press, N.Y.	$1.35
3. Gamebirds — A Golden Nature Guide — Sprunt and Zim, pp. 160, 1961	Golden Press, N.Y.	$1.35
4. Waterfowl Hunters' Guide, Department of Northern Affairs & National Resources, pp. 36, 1962	Queen's Printer, Ottawa	$ .25

Geology

1. A Field Guide to Rocks & Minerals — Pough (Peterson Series) pp. 349, 1953	Houghton Mifflin Co., Boston	$5.95
2. Rocks & Minerals — A Golden Nature Guide — Zim, pp. 160, 1956	Golden Press, N.Y.	$1.35

Soil

1. Making Money by Saving Soil, pp. 20, 1956	The Royal Bank of Canada, Box 6001, Montreal	Free
2. Conservation in Canada — McConkey pp. 410, 1950	J. M. Dent & Sons, Hunter Rose Co., Toronto	$5.00

Insects

1. The Insect World — John Pallister	Ryerson Press	$3.95
2. The Golden Bookshelf of Nature History — Insects — R. M. Baronowski	Musson Book Co.	$4.59

Insects and Relatives

1. Insects — A Golden Nature Guide — Zim and Cottam, pp. 160, 1951	Golden Press, N.Y.	$1.35
2. A Field Guide to the Butterflies — A. Klots (Peterson Series) pp. 349, 1951	Houghton Mifflin Co., Boston	$5.95
3. Insects Vest Pocket Nature Guides — Ottenheimer, pp. 96, 1960	Ottenheimer Publishers, Baltimore 15, Maryland	$1.00
4. Field Book of Insects — Lutz, pp. 510, rev. 1948 (A Putnam Nature Field Book)	G.P. Putnam's Sons, New York 16, N.Y.	$4.95
5. Insects — Golden Nature Guide — Zim	Golden Press, N.Y.	$1.35

Stars

1. A Field Guide to the Stars & Planets — Menzel (Peterson Series) pp. 397, 1964	Houghton Mifflin Co., Boston	$5.95
2. The Star Guide — E. Sicotte (French)		

3. Hammonds Handy Star Finder & Home Planetarium	McClelland & Stewart, Toronto	$1.65
4. Stars — A Golden Nature Guide — Zim pp. 160, 1955	Golden Press, N.Y.	$1.35

Weather and Climate

1. Weather — A Golden Nature Guide — Lehr and Burnett, pp. 160	Golden Press, N.Y.	$1.35
2. Weather and Why — R. A. Hornstein, Department of Transport, pp. 61, 1963	Queen's Printer, Ottawa	$ .50

Wildflowers

1. Native Wild Plants of Eastern Canada — F. H. Montgomery, pp. 193, 1962	Ryerson Press, Toronto	$4.25
2. Flowers — A Golden Nature Guide — Zim, pp. 157, 1962	Golden Press, N.Y.	$1.35
3. Forest Flora of Canada (English & French) Bul. 121. G. C. Cunningham, pp. 144, 1958	Queen's Printer, Ottawa	$1.50
4. Wildflower Guide — E. T. Wherry, pp. 202, 1948	Doubleday & Co. Inc., N.Y.	$3.75

Grasses, Herbs, Weeds

1. Weeds of Canada (English & French) Pub. 948 — C. Frankton, pp. 196, 1955	Queen's Printer, Ottawa	$1.30

Fern and Mosses

1. A Field Guide to the Ferns — Cobb (Peterson Series)	Houghton Mifflin Co., Boston	$5.95
2. Forest Flora of Canada (English & French) Bul. 121. G. C. Cunningham, pp. 144, 1958	Queen's Printer, Ottawa	$1.50
3. Native Ferns of Eastern North America — The Canadian Audubon Society, pp. 64, 1947	46 St. Clair Avenue East, Toronto	$1.00

Mushrooms

1. Edible & Poisonous Mushrooms of Canada Pub. 1112, J. Walter Groves, pp. 298, 1962	Queen's Printer, Ottawa	$7.75
2. Mushroom Collecting for Beginners Pub. 861, Canada Department of Agriculture, pp. 30, 1951	Queen's Printer, Ottawa	$ .35

Trees and Shrubs

1. Native Trees of Canada, pp. 293, rev. 1961	Queen's Printer, Ottawa	$2.50
2. 50 Trees of Canada — East of the Rockies — J. L. VanCamp		$ .50
3. Tree Seedlings of Eastern Canada (English and French)	Queen's Printer, Ottawa	$1.35
4. Trees — A Golden Nature Guide — Zim & Martin, pp. 160, 1956	Golden Press, N.Y.	$1.35

General References

1. A Field Book of Natural History — E. Lawrence Palmer, pp. 664, 1949	McGraw-Hill Co., Toronto	$10.00
2. The Field Book of Nature Activities and Conservation — W. Harcourt (A Putnam Nature Field Book)	G. P. Putnam's Sons, New York 16, N.Y.	$4.95
3. Conservation and Nature Activities Canadian Nature Magazine, pp. 256, 1951	Audubon Society of Canada, 46 St. Clair Avenue East, Toronto	$2.50
4. Hammerman, D. R. & Hammerman, W. M. — Teaching in the Outdoors	Burgess Publishing Co., Minneapolis, 1964	
5. National Association of Biology Teachers Manual for Outdoor Laboratories — Weaver, Richard L., editor, 1959	Interstate Printers & Publishers, 19-29 North Jackson Street, Danville, Ill.	
6. Laboratory & Field Studies in Biology — C. A. Lawson & R. E. Paulson	Holt, Rinehart & Winston	$2.88

7. Sankey, John, **A Guide to Field Biology,** Longmans, 1958. 166 pp.
(This book by the warden of Juniper Field Centre describes tools, techniques and methods for field work with soil, plants and animals.)

8. Bennett, Donald P. and Humphries, David A. **Introduction to Field Biology,** Edward Arnold. 1965. 208 pp.
(This book gives brief accounts of fieldwork techniques and attempts from the start to explain how these techniques should be used to clarify and solve problems.)

9. Ford, V. E., **How to Begin Your Field Work: Woodland,** John Murray. 1959, 48 pp.
(This booklet published for the Association for Science Education includes work for pupils and students of all types and ages, even for a student working to a great extent alone.)

10. Benton, B. H. and Werner, W. E., **Principles of Field Biology and Ecology,** McGraw-Hill. 1958. 341 pp.
(This book on principles and practices, but not techniques, cites many case histories, and gives background in ecology.

11. Hug, John W. and Wilson, P. J., **Curriculum Enrichment Outdoors,** Harper and Row, (available from Copp Clark). 1965. 214 pp.
(This book suggests 350 activities for children in the fields of language, social studies, mathematics, arts and crafts, music and movement, science, and games.)

12. Phillips, E. A., **Methods of Vegetation Study,** Henry Holt. 1959. 108 pp.
(This book presents a great diversity of concepts and methods, based on systems used in America, Great Britain and the Continent by leading ecologists.)

Appendix

CENTRAL PUBLIC SCHOOL

February, 1969

To Parents of Children in Miss Smith's Room:

RE: Field Trips

This year the children in Miss Smith's room will be making a number of short excursions within walking distance of the school.

The purpose of these excursions will be to acquaint the students with concepts of science and social studies that are better learned in their natural environment. The material so learned will become an important part of their English program.

School insurance will be in effect for those who have that coverage. There will be adequate supervision.

Below, will you please indicate if you wish your child to participate in these activities.

Principal: .....

PERMISSION SLIP

☐ I am pleased to give my child, ... permission to go on these excursions.

☐ Thank you, but I would rather that ..... not take part.

Parent: .....